6-in. High Pressure Large-Diameter Pipeline

This facility operates with gas/oil/water and has been designed to study the effects of pressure on multiphase flow characteristics.

Key Specifications

Fluids

Gas: Nitrogen, Air, Natural Gas
Water: Tap Water
Oil: Mineral Oil

Operating Conditions[1]

Maximum Pressure:	500 psig
Temperature:	Ambient
Gas Flow Rate:	0 to 18 MMSCFD (Superficial Gas Velocity – 0 to 33 ft/s)
Water Flow Rate:	0 to 6800 BPD (Superficial Liquid Velocity – 0 to 2.3 ft/s)
Oil Flow Rate	0 to 6800 BPD (Superficial Liquid Velocity – 0 to 2.3 ft/s)

[1]Operating conditions are for the current project and are subject to change depending upon the project

Test Section

Pipe Material:	Stainless Steel Schedule 40
Diameter of Pipe:	6 inch
Total pipe length:	523.0 ft (1046 D)
Test Section:	65.0 ft (130 D), long section 29.5 ft (59 D), short section
Developing Region:	60.0 ft (120 D, CW), 75 ft (150 D, CCW), long section 29.5 ft (59 D, CW), 26.5 ft (53 D, CCW), short section
Inclination Angles:	-3 to 3 degree

Instrumentation and Flow Characteristics

Measured Parameters	Instrumentation
Liquid Holdup	• Quick Closing Valves • Canty Device • Wire Mesh Sensor
Flow Pattern	• Canty Device • Hi-speed Camera

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	• Wire Mesh Sensor
Pressure Gradient	• Differential Pressure Transducer
Wetted Wall Fraction	• Canty Device • Hi-speed Camera • Wire Mesh Sensor
Liquid Film Height	• Wire Mesh Sensor
Entrainment	• Iso-Kinetic Sampling Probe

Detailed Specifications on Liquid and Gas Supply Systems

Air Compressor

Model:	(Single stage) Sundyne BMC-343 EF
Power:	298 kW (400 HP) supplied by Kohler power generator
Flow Rate:	19 MMSCFD
Discharge Pressure:	500 psig
Suction Pressure:	400 psig

Gas Flow Meter 1

Model:	CMF100
Nominal Mass Flow Rate:	13,600 kg/h
Max. Mass Flow Rate:	27,200 kg/h
Measurement Uncertainty:	±0.35% of Flow Rate

Gas Flow Meter 2

Model:	CMF300
Nominal Mass Flow Rate:	136,080 kg/h
Max. Mass Flow Rate:	272,160 kg/h
Measurement Uncertainty:	±0.35% of Flow Rate

Oil Pump

Model:	Moyno Progressing Cavity Pump
Discharge Rate:	6800 BPD
Suction Diameter:	4 inches
Discharge Diameter:	4 inches

Oil Flow Meter 1

Model:	CMF200
Nominal Mass Flow Rate:	43,550 kg/h
Max. Mass Flow Rate:	87,100 kg/h
Measurement Uncertainty:	±0.35% of Flow Rate

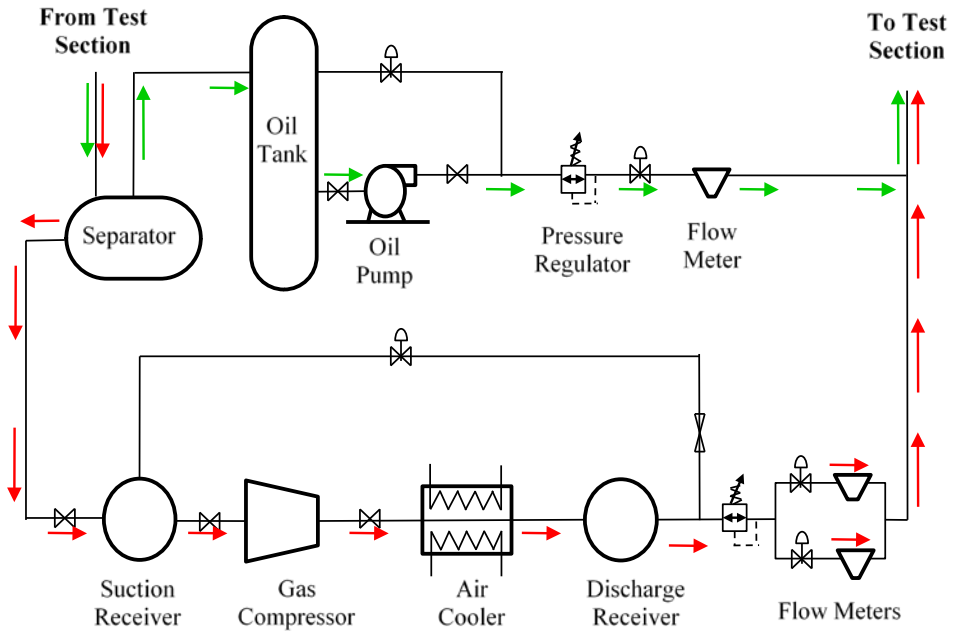

Figure 1. Schematic of 6-in. High Pressure Large-Diameter Pipeline Flow Loop

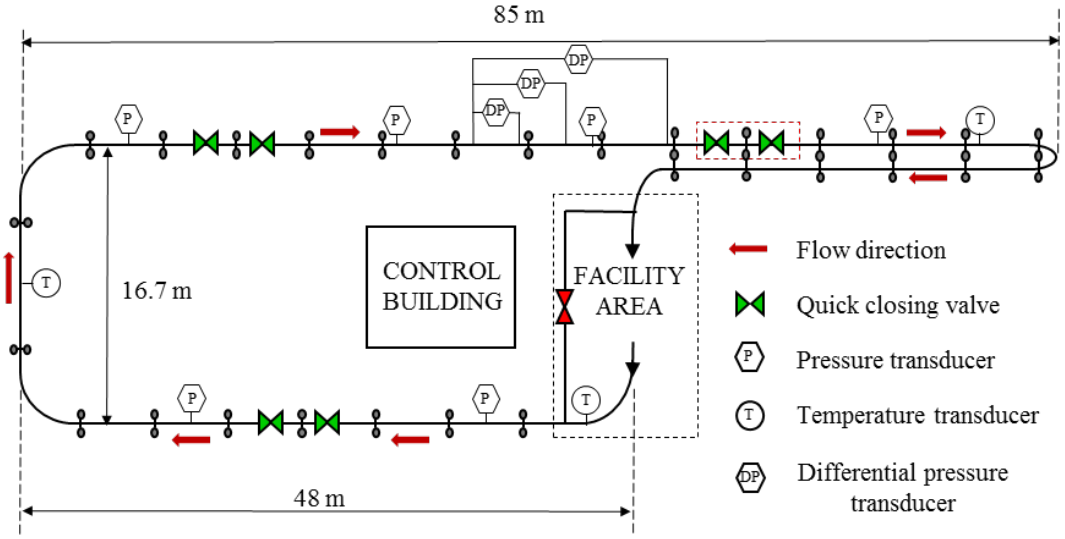

Figure 2. Schematic of Test Section

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Figure 3. View of 6-in. High Pressure Large-Diameter Pipeline Flow Loop

Figure 4. Closed up view on the instrumentation installed at the test section

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Visual Observation

A free disturbance flow and custom made visualization system with no disturbance to flow has been designed and constructed proposed by JMCanty Company. The schematic of the system is shown in Figures 5. An acrylic section is fused with two steel pipe pieces. A chamber surrounds the acrylic section and welded to the steel pipe pieces. The chamber is pressurized keeping the stress over the acrylic section below a critical value. Lights and cameras are located around the circumference of the pipe. The two light sources (HYL 250 Watt) are located at a 90° angle from each other. A JMCanty still picture process camera is located at 90° from the lights. The system is equipped with a side window located at 90° from the camera, where the actual high speed video system (Ultima 120kc) can be connected.

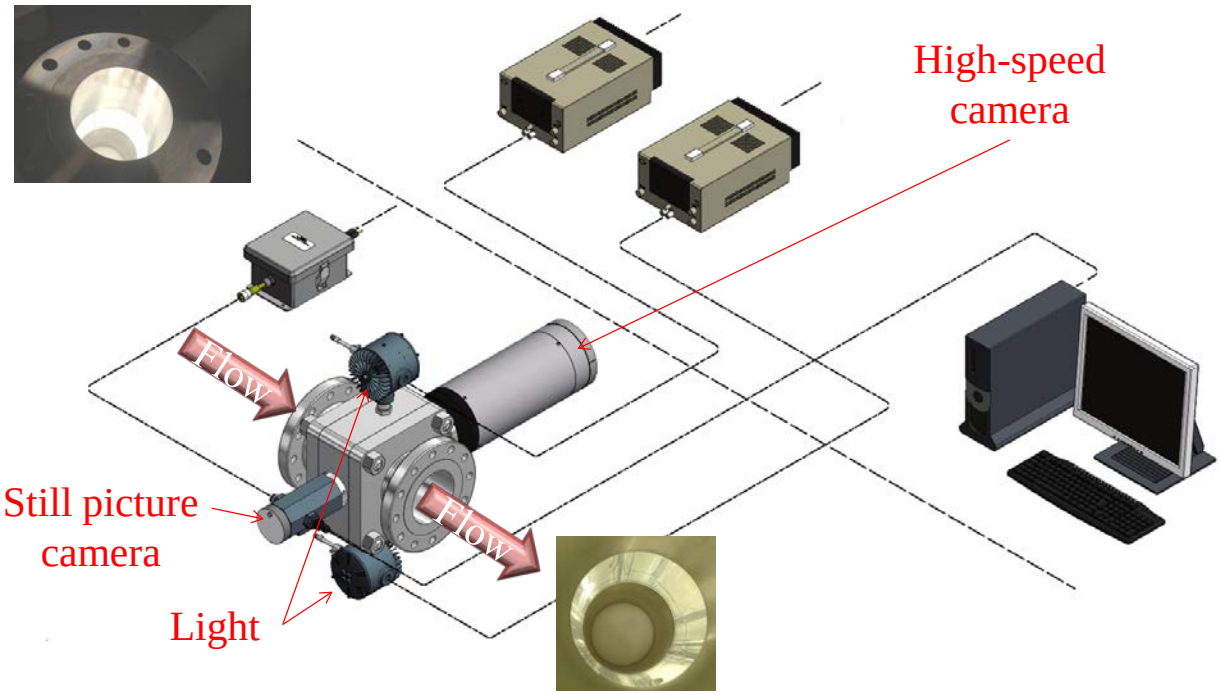

Figure 5: Schematic of Canty Visualization System